FEATURES

A Guide To Addressing Lateral Ankle Instability

Peter Walimire, DPM, Joshua Daly, DPM, MBA, and Joseph A. Conte, DPM

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Given the common nature of lateral ankle sprains and the development of chronic ankle instability in some of these patients, these authors offer key diagnostic tips, share their thoughts on conservative modalities and review the literature on surgical options.

Ankle sprains are reportedly the most common musculoskeletal injury in the United States. Approximately 30,000 occur each day and account for 40 percent of sports medicine injuries.[1,2] Researchers have estimated that 85 percent of ankle sprains are lateral ligamentous injuries, 10 percent are tibiofibular syndesmotic injuries and 5 percent are medial deltoid ligament injuries.[3]

Ex. 36-4

Boden v. USA
7:18-CV-256

The majority of these injuries heal uneventfully with traditional methods of conservative treatment such as temporary immobilization, rest, ice, compression, elevation and either home or formal physical therapy exercises. However, some patients develop recurrent sprains or chronic ankle instability.4 When it comes to the patient with an unstable ankle, one would employ conservative treatment modalities first. However, if the condition persists, there are numerous surgical options ranging from open or arthroscopic repair of the ligamentous complex to secondary repair utilizing tendon grafts or tissue substitutes.5 Regardless of which treatment modality one ultimately employs, excellent outcomes in stability and function can occur when treating chronic lateral ankle instability.

Salient Pointers On Mechanical And Functional Instability

Lateral ankle instability, whether chronic or acute, can be defined as mechanical or functional.

Mechanical instability is excessive motion beyond normal physiologic ranges.6 One can observe this either clinically by performing the anterior drawer test and/or radiographically using stress inversion and anterior drawer techniques. This abnormal motion is frequently present following an acute injury but typically resolves after up to 12 weeks of conservative care. Chronic mechanical instability may arise from a singular incident but it typically follows a pattern of repeated injury.

Functional instability is a chronic disorder defined as a subjective complaint of the ankle "giving way" without any clinical or radiographic findings of instability. This represents a loss of neuromuscular control. This has typically been regarded as a loss of proprioceptive input secondary to ligamentous injury. (See "A Pertinent Overview Of Anatomical Insights" on page 54.)

However, the location of the end proprioceptive organs is a subject of debate. While there is no debate that numerous nerve fibers are in the mechanoreceptors of the joint capsule and ligaments, recent studies have demonstrated that proprioceptive input arises from the skin and muscle, and may not depend on the capsular or ligamentous fibers. The afferent signals from proprioceptors, especially pressure receptors on the plantar foot, trigger a peripheral reflex and muscle activation, specifically the peroneal muscles, following an unexpected inversion movement at the ankle joint. The peroneal musculature provides the "dynamic defense system," a strong contraction triggered by the proprioceptive reflex arc.

The typical position of the foot at injury, plantarflexed and inverted, prepares the foot to be supported by this dynamic defense system by preactivating the peroneals prior to ground contact. This increases segmental reflex activity and stretch velocity of these muscles. Research has demonstrated that braces and tape shorten the peroneal reaction time. Also bear in mind that the peroneal tendons provide five times greater resistance to inversion to protect the ankle than any tape, brace or shoe.

Patients with functional instability of the ankle have demonstrated delayed peroneal reaction time and decreased balance capability on the affected side in comparison to patients without this complaint.

Therefore, it is of utmost importance to restore this reaction time utilizing physical therapy techniques.13 Previous studies have stated that peroneal muscle weakness can cause functional ankle instability. However, researchers have refuted this hypothesis when it comes to comparing muscle strength and balance control.14

Essential Diagnostic Pearls

Studies have previously noted that many patients who demonstrate both functional and/or mechanical instability of the ankle frequently present for treatment following a recurrent acute injury. A thorough history and physical examination should elicit the necessary information to suspect mechanical or functional ankle instability.6

One would diagnose mechanical instability utilizing the anterior drawer and talar tilt (stress inversion) exams. Always perform a contralateral comparison with both of these exams. Physicians may utilize radiography with these exams and may stress the ankle manually or with a Telos device. Researchers have described several methods for measuring anterior excursion of the talus.9 However, it is typically accepted that a value greater than 10 mm of anterior displacement is pathologic. Contralateral comparisons greater than 3 mm are also considered to be pathologic. Talar inversion greater than 9 degrees and greater than 3 degrees in comparison to the contralateral limb is considered pathologic for the stress inversion exam.15

One would make the diagnosis of functional ankle instability through a careful assessment of balance and postural control. Single leg balance is mediated through proprioceptive input of the supporting limb. However, overall balance and postural control is centrally mediated. Several studies utilizing stabilometry have demonstrated that functional instability is not the result of peripheral proprioceptive deficits.

The tests physicians most commonly use to diagnose functional ankle instability are the modified Romberg test, the single leg hop and balance tests on an ankle disk or wobble board.

The modified Romberg test is a single leg balancing test that the patient performs with his or her eyes open and closed, and arms placed across the chest. A fall to the side occurring in less than 30 seconds is a positive result. Patients perform the single leg hop in a single leg stance. The patient rises onto the forefoot and then performs this maneuver five times in a successive fashion. This test may be limited by pain or weakness. When it comes to the balance test on a disk or wobble board, patients should perform it as a single leg test for at least 30 seconds, both with and without shoes.13

Note that lateral ankle instability can also be caused by non-traumatic conditions such as the hereditary ligamentous laxity that is associated with Ehlers-Danlos syndrome, Marfan's syndrome and Turner's syndrome. Additional structural deformities of the foot, ankle and leg, including calcaneal varus, a rigid plantarflexed first ray/forefoot valgus, tibial varum, ankle varus, uncompensated equinus

and limb length discrepancies can lead to an increased risk of inversion injuries.9

What You Should Know About Conservative Treatment

Following an acute injury, immobilization in a compression dressing, cast or fracture boot with ice and elevation is indicated. Traditional treatment approaches include three to six weeks of prolonged immobilization.

However, Pijnenburg demonstrated that functional rehabilitation, divided into three phases, is superior to prolonged immobilization in regard to pain, stability and functional outcomes.16 The initial phase lasts one to two days, and consists of traditional protection, rest, ice, compression and elevation (PRICE) therapy. Phase two entails initiation of passive and active ankle and subtalar joint range of motion exercises as well as strengthening exercises of the dorsiflexors and everters of the foot. Patients should continue these exercises throughout treatment. The third phase consists of ankle disk and wobble board training, which patients can utilize to rehabilitate any proprioceptive, balance and postural deficits.

Patients may utilize taping and external devices such as bracing. Numerous ankle bracing devices are available and one can choose these based upon the physician's and patient's preference. Patients should use these devices for up to six months following a severe ankle sprain.17

Many patients with functional instability of the ankle do not demonstrate a concurrent mechanical instability. These patients have no structural deformities and therefore do not warrant surgical intervention. Conservative treatments should focus on a rigorous physical therapy program with the goal of balance, postural and proprioceptive improvements. Ankle disk and wobble board training have demonstrated excellent results in decreasing peroneal reaction time and improving overall balance and posture scores. These techniques are the cornerstone of rehabilitation programs.13

Lofvenberg followed patients with chronic lateral ankle instability who underwent conservative treatment for 20 years. Approximately 8 percent of the patients studied stated that their instability interfered with their activities of daily living enough to seek further treatment. The most unanticipated result of this study was that in comparison to control patients, there was no increased incidence of osteoarthritis in the population with chronic lateral ankle instability.18 The length of conservative treatment prior to surgical intervention will vary from patient to patient and often depends upon the patient's response to therapy.

Exploring The Surgical Options

One should entertain surgical treatment only after conservative efforts fail, the patient continues to experience chronic pain and edema, or if the instability of the ankle interferes with daily activities. Surgical treatment of the chronically unstable ankle can be divided into two main categories: primary

ligamentous repair and tenodesing procedures.

The main indication for a primary repair is mild mechanical instability. Contraindications to primary repair include: patient weight greater than 250 pounds; failure of previous primary repair; prolonged instability greater than 10 years; and radiographic evidence of joint degeneration.6

The traditional procedure surgeons perform is the modified Brostrom-Gould procedure.19 Begin the procedure by making a curvilinear incision along the anterior inferior border of the lateral malleolus with the vertical arm over the lateral gutter and the horizontal arm directed posteriorly, just distal to the peroneal tendons. Carry dissection to the joint capsule, maintaining the subcutaneous tissues in a single layer. Identify the peroneal tendon sheath inferiorly and sharply incise it. Then inspect the peroneal tendons and retract them distally to expose and inspect the calcaneofibular ligament (CFL). Incise the joint capsule in order to visualize and inspect the anterior talofibular ligament (ATFL).

Then place the foot in a dorsiflexed and everted position. Repair mid-substance ruptures of the ATFL and CFL primarily, utilizing non-absorbable suture in a "pants over vest" fashion. If a ligament has ruptured near its bony insertion, repair the ligament by inserting a soft tissue anchor into the bone. Take care to achieve physiologic tension on the ligament during the repair. Dissect the inferior extensor retinaculum, advance it proximally and suture it to the lateral joint capsule and periosteum of the lateral malleolus. This helps restore stability to both the ankle and subtalar joints.6

Brostrom reported excellent results in his original articles, noting that 43 out of 60 patients reported complete resolution of symptoms and all but one patient achieved some improvement.20 Bell demonstrated 96 percent good to excellent outcomes in a 26-year follow-up with anatomic repair of the lateral ankle ligaments.21

The literature has described arthroscopic repair of the ligament. Since the ATFL is intracapsular, one may visualize and repair it from inside the joint capsule. The advantage to arthroscopic repair includes the ability to visualize the joint surfaces and perform any necessary intra-articular repairs.

Komenda and Ferkel found that 93 percent of ankles with lateral instability had associated intra-articular abnormalities, including loose bodies, synovitis, osteophytes, adhesions and chondromalacia.22 The techniques researchers have described for arthroscopic repair include arthroscopic stapling and thermal shrinkage utilizing monopolar radiofrequency.23 Ryan demonstrated good to excellent results in 11 out of 13 patients with functional instability following arthroscopic repair of the ATFL in an early follow-up cohort.24 Oloff also demonstrated a significant reduction in mechanical instability through preoperative and postoperative measurements of the talar tilt and anterior drawer tests following arthroscopic thermal assisted capsular shrinkage.5

What The Literature Reveals About Tenodesing Procedures

Tenodesing procedures are indicated when delayed primary repair has failed, in patients weighing

greater than 250 pounds, and if patients have experienced instability for greater than 10 years.25,26 These procedures attempt to stabilize the lateral ankle using either tendon autograft or allograft. A common complication of tenodesis procedures is restriction of subtalar joint inversion. However, this aids in the stability of the lateral ankle following the repair.4

Traditionally performed, autograft procedures commonly involve harvesting the peroneus brevis, peroneus longus, plantaris or Achilles tendons, often in a split fashion, and rerouting it throughout the lateral ankle.12 These procedures create non-anatomic repairs but have the benefit of using vascularized structures with no risk of foreign body rejection or inflammatory reaction.

Allograft procedures are increasingly being incorporated into the surgical options for the unstable ankle patient, possibly due to the increased availability of donor tendon grafts. Although they carry with them the inherent risks mentioned above, allografts also have the benefit of allowing for an anatomic repair since they are not limited by origin or insertion of the natural tendon structures.27

For both autograft and allograft procedures, researchers have described numerous techniques, which can generally be divided into single or double ligament reconstruction.

Single ligament reconstruction procedures include the Watson-Jones, Lee and Evans procedures. There have been mixed results in the literature with these repairs. Peters performed a retrospective review of 250 Watson-Jones stabilizations in 250 ankles and demonstrated that 95 percent of patients regained stability and 80 to 85 percent had good to excellent outcomes.12 A long-term retrospective study of nine patients with an average of 22 years follow-up who underwent the Watson-Jones procedure demonstrated loss of stability in six patients.28 Other authors have also noted loss of stability following single ligament tenodesis procedures.29-31

The most common double ligament reconstruction procedure is the Chrisman-Snook procedure, which is a split peroneus brevis graft. Snook reported on 48 patients with an average follow-up of 10 years and observed 93 percent good to excellent results from their procedure.32

Researchers have also described triple ligament reconstruction in cases of severe ankle sprains. However, surgeons typically perform this infrequently in the acute setting.12

As for postoperative care, patients typically undergo a period of immobilization and non-weightbearing for four to eight weeks. This may be shorter if the physician can trust the patient to remain in protected weightbearing. One should follow all procedures with a course of physical therapy as previously described to rehabilitate ankle and subtalar joint range of motion and restore stability.12

In Summary

Lateral ankle instability is a common problem we see in our practices. The instability can be mechanical or functional, and many patients with functional instability do not have

evidence of mechanical instability as well. Ligamentous structures remain intact with functional instability. Therefore, one should only treat this condition conservatively.

Treatment of the lateral ankle sprain should always begin with physical therapy modalities to avoid chronic instability. Should instability persist, numerous surgical options are available to the podiatric surgeon. These procedures include primary ligamentous repair, arthroscopic procedures and tenodesing procedures. Post-operative results demonstrate excellent outcomes yet one should still treat patients with physical therapy modalities to restore range of motion, proprioception, balance and posture.

Dr. Walimire is the Chief Resident of the Florida Hospital Podiatric Medicine and Surgery Residency Program in Orlando, Fla.

Dr. Daly is a second-year resident at the Florida Hospital Podiatric Medicine and Surgery Residency Program in Orlando, Fla.

Dr. Conte is an Attending Physician with the Florida Hospital Podiatric Medicine and Surgery Residency Program in Orlando, Fla. He is an Associate of the American College of Foot and Ankle Surgeons.

For further reading, see "How To Diagnose Lateral Ankle Injuries" in the August 2005 issue of Podiatry Today, "Chronic Ankle Instability: Can Orthotics Help?" in the October 2006 issue, or "Practical Keys To Improving Fluency In Foot And Ankle Surgery" in the September 2008 issue.

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